REMARKS

The Examiner is thanked for the clarity and conciseness of the Office Action and for the citation of the references which have been studied with interest and care.

Specification

The disclosure was objected to because of the informality of failing to indicate the serial number of a related application. Appropriate correction has been made.

Claim Rejections - 35 U.S.C. § 112

Claims 2-4, 8 and 14 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 2, the change suggested by the Examiner has been made. With respect to claims 3, 4 and 14, "the coating" has been amended to recite "the electrically conductive coating" to clarify which element of the coated fuel cell bipolar plate is being referred to. With respect to claim 8, it is respectfully submitted that the language "graphite flakes which have been processed through an intercalation process" is clear, particularly in consideration of the detailed description. Referring to page 12 of the subject patent application, an exemplary preferred overcoating 406 is described as comprising:

> exfoliated graphite in the form of sheets of flexible, graphite foil such as those manufactured by UCAR Carbon Company Inc., P.O. Box 94637, Cleveland, Ohio 44101 and sold under the trade name, GRAFOIL®. The graphite foil, GRAFOIL®, is formed from particulate graphite flakes which have been processed through an intercalation process.

[Specification, page 12, lines 18-24.] In view of the amendments to the claims and for the reasons discussed above, withdrawal of this rejection is respectfully requested.

Double Patenting

Claims 1-20 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-39 of copending Application No. 09/415,466. More specifically, it was stated in the Office Action that:

> Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of both applications are directed toward bipolar plates for fuel cells having a first electrically conductive coating formed thereon. A second overcoating is formed on the first overcoating and is electrically conductive.

[Office Action, pages 3-4.]

If this provisional rejection is repeated in the next Office Action, a terminal disclaimer in compliance with 37 C.F.R. 1.321(c) will be timely filed in the present application or arguments against the rejection will be submitted for the Examiner's consideration.

Claim Rejections - 35 U.S.C. §§ 102, 103

Claims 1, 3-5, 8-11, 13-15 and 18-20 were rejected under 35 U.S.C. 102(b) as being anticipated by Toshiaki et al. (JP 57105974). Applicants have obtained and studied a translation of this Japanese-language reference, a copy of which is enclosed for the Examiner's consideration. The translation was prepared by Patent Translations Inc. 1-800-844-0494 mail@PatentTranslations.com.

Toshiaki et al. discloses a fuel cell interconnector which comprises grooves for the purpose of fluid fuel channels and fluid oxidizer channels, and performs a current collector function. FIG. 3 of Toshiaki et al. shows a perspective view of an interconnector 18. The interconnector 18 is coated with a mixed coating 19 of a heat resistant and chemically resistant binder (Teflon-based adhesive)[1] and particulate graphite in the form of a paste. The mixed coating 19 is spread on thinly as a paste mixture of a heat resistant and chemically resistant thermosetting or thermoplastic binder and particulate graphite, or a dispersed solution of the

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[1] Polytetrafluoroethylene (PTFE), better known by the trade name TEFLON®, is known <u>not</u> to wet and bond to graphite, and this is problematic for producing a coating that is both mechanically integral and conductive.

mixture is sprayed on to form a thin film; and thereafter this is heat treated to form a thermally and chemically stable coating.

FIGs. 4(a) and 4(b) of Toshiaki et al. show a variant of the ribbed metal interconnector 18, namely, a thin sheet bent into a rectangular waveform to form a ribbed metal interconnector substrate 24. Reference numeral 25 indicates grooves in the form of spaces resulting from the rectangular waveform. Reference numeral 26 indicates a partition (no material called out) which prevents fluids from flowing into these spaces. Reference numeral 27 indicates a heat resistant and chemically resistant electroconductive coating.

At page 4 of the Office Action, the Examiner is apparently taking the position that the metal layer 24 of Toshiaki et al. teaches a "coating" as claimed by Applicants. To the contrary, the metal layer 24 is a thin sheet bent into a rectangular waveform to form a ribbed metal interconnector substrate, and the partition 26 appears to be a plug of some sort positioned at the end of the groove 25. Thus, it is respectfully submitted that Toshiaki et al. does not disclose or suggest the subject matter set forth in independent claims 1, 13 and 20.

Furthermore, even if it is assumed *arguendo* that the metal layer 24 teaches a "coating", then Toshiaki et al. clearly fails to disclose or suggest the three-layered structure as claimed by Applicants wherein: the coating is a graphite emulsion (claim 3); the coating includes graphite particles in an organic suspension (claim 4); and the coating is an emulsion, suspension or paint including graphite particles (claim 14).

The mixed coating disclosed in Toshiaki et al., with its non-continuous "particulate graphite" interconnecting network, is limited in its conductivity by the non-conducting binder phase of the thermosetting or thermoplastic polymer. Moreover, Toshiaki et al. clearly fails to disclose or suggest an intercalation process by which a graphite crystal is opened out to produce flakes of graphite ("exfoliated graphite") which retain the crystal structure of the graphite crystal and hence retain the anisotropies present in the crystal.

Thus, further assuming *arguendo* that the metal layer 24 teaches a "coating", it is respectfully submitted that Toshiaki et al.'s teaching of "particulate graphite" fails to disclose or suggest the three-layered structure as claimed by Applicants wherein: the overcoating includes exfoliated graphite (claims 5 and 15); the overcoating includes particulate graphite flakes which have been processed through an intercalation process (claim 8); and the overcoating is anisotropic (claim 11).

In view of Applicants' amendments and for the reasons discussed above, withdrawal of this rejection is respectfully requested as Toshiaki et al. fails to disclose or suggest the subject matter of claims 1, 3-5, 8-11, 13-15 and 18-20.

Claims 1, 2, 9-11, 13 and 18-20 were rejected under 35 U.S.C. 102(e) as being anticipated by Spear, Jr. et al. (6,051,331).

Spear, Jr. et al. discloses fuel cells comprising separators with electrode membrane assemblies (EMAs) sandwiched therebetween. The separators comprise cell platelets which are constructed of metal, typically, aluminum, copper, stainless steel, niobium or titanium. A passivating or an anticorrosive and conductive titanium nitride layer is formed on all exposed surfaces of the separator plates. The preferred EMA comprises a 2-17 mil thick sulfonated perfluorinated membrane coated on both sides with a mixture of microfine Pt-black and carbon black in a solvent, and overlain on each side with a 10 mil thick 65% open graphite paper having a Teflon hydrophobic binder therein.

As a preliminary matter, the graphite paper disclosed in Spear, Jr. et al. is not part of a bipolar plate. Furthermore, the graphite paper in Spear, Jr. et al. does not provide a barrier to corrosion because it is 65% open in order to facilitate transport of reactants. [column 5, lines 63 - 65.] If the graphite paper in Spear, Jr. et al. were filled with a graphite emulsion, it would be rendered inoperable. Moreover, the titanium nitride layer disclosed in Spear, Jr. et al. does not bond the graphite paper to the separator; rather, the separators and EMAs are pressed into a stack by a compressive force. Additionally, Spear, Jr. et al. does not disclose or suggest mechanically deforming a metal plate, a coating and an overcoating to create a flow field.

In view of Applicants' amendments and for the reasons discussed above, withdrawal of this rejection is respectfully requested as Spear, Jr. et al. fails to disclose or suggest the subject matter of claims 1, 2, 9-11, 13 and 18-20.

Claims 1-5, 8, 9, 13-15, 18 and 19 were rejected under 35 U.S.C. 103(a) as being unpatentable over Faita et al. (5,578,388).

Faita et al. discloses an electrochemical cell with a collector, in the form of a tridimensional network (FIG. 5). Faita et al. discloses that "the bipolar plates may be made of aluminum, titanium or alloys thereof, without electroconductive protective coatings when used in connection with the collectors of the present invention." [column 8, lines 29-32.] This reference also discloses that the collectors and the bipolar plates may be *optionally* coated with an

electroconductive protective film, for example, made of platinum group metals or oxides thereof, and that alternatively, the protective film may be made of conductive polymers of the type comprising intrinsically conductive materials such as polyacetylenes, polypyrroles, polyanilines or the like or plastic materials containing conductive powders (for example, graphite powder). [column 10, lines 29-37.]

According to Faita et al., the high pressure localized in the limited-area contact points between the bipolar plates and the collectors causes a rupture of an electrically insulating oxide film or prevents its growth. [column 8, lines 36-39.] In fact, an advantage of the Faita et al. electrochemical cell is higher simplicity and lower production costs, in particular for the bipolar plates made of aluminum or other passivatable metals *without any protective coating*. [column 10, lines 55-58.]

At page 6 of the Office Action, it was asserted that the skilled artisan would have known that the two coatings disclosed in Faita et al. could be used together to further protect the bipolar plates from corrosion. Applicants respectfully traverse this assertion for the reasons discussed below.

As noted by the Examiner, Faita et al. does not explicitly teach that the bipolar plate is coated with a first electroconductive layer and then coated with a second layer containing graphite. Nor does Faita et al. include any teaching or suggestion that it would be desirable to so combine these coatings. What Faita et al. does teach is a collector, in the form of a tridimensional network, that eliminates the need for a protective coating. Furthermore, it is respectfully submitted that Faita et al. does not disclose or suggest a "corrosion resistant overcoating" as claimed by Applicants. Rather, Faita et al. merely discloses an *optional* electroconductive protective film, for example, made of platinum group metals or oxides thereof. In the Faita et al. electrochemical cell, the function of corrosion rupturing or prevention is instead provided by the collector.

In view of Applicants' amendments and for the reasons discussed above, withdrawal of this rejection is respectfully requested as Faita et al. fails to disclose or suggest the subject matter of claims 1-5, 8, 9, 13-15, 18 and 19.

Allowable Subject Matter

At page 7 of the Office Action, it was indicated that claims 6, 7, 12, 16 and 17 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 6, 7, 12, 16 and 17 have been rewritten as suggested by the Examiner in the form of new claims 21-25. Allowance of claims 21-25 is respectfully requested.

CONCLUDING REMARKS

Applicants submit that the application is in condition for allowance. Concurrence by the Examiner and early passage of the application to issue are respectfully requested.

Any additional fees which are required in connection with this communication and which are not specifically provided for herewith are authorized to be charged to deposit account no. 01-1125. Any overpayments are also authorized to be credited to this account.

Respectfully submitted,

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Version with markings to show changes made

In the Specification

At page 1, delete lines 3-5 and insert the following paragraph:

-- This application is related to U.S. patent application serial number [ ] 09/415,466 entitled "Corrosion Resistant Coated Fuel Cell Bipolar Plate With Filled-In Fine Scale Porosities and Method of Making the Same" filed herewith.--

In the Claims

1. (Amended) A coated fuel cell bipolar plate comprising:

a metal plate [including an outer surface];

an electrically conductive coating over the [outer surface] metal plate; and

[an] a corrosion resistant overcoating formed over the electrically conductive coating, the corrosion resistant overcoating including graphite;

wherein the electrically conductive coating bonds the corrosion resistant overcoating to the metal plate.

2. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the metal plate [is formed with] comprises aluminum.

3. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the electrically conductive coating is a graphite emulsion.

4. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the electrically conductive coating includes graphite particles in an organic suspension.

5. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, where the corrosion resistant overcoating includes exfoliated graphite.

6. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating includes porosities that are filled by the <u>electrically conductive</u> coating.

7. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating is a foil.

8. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating includes particulate graphite flakes which have been processed through an intercalation process.

9. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating is electrically conductive.

10. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating is hydrophobic.

11. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating is anisotropic.

12. (Amended) A coated fuel cell bipolar plate as claimed in claim 1, wherein the <u>corrosion resistant</u> overcoating has a thickness approximately between 0.04 and 1.0 millimeters.

13. (Amended) A method of manufacturing a coated bipolar plate for a fuel cell, the method comprising the steps of:

providing a metal plate [with an outer surface];

providing an electrically conductive coating over the [outer surface] <u>metal plate</u>; and

providing [an] <u>a corrosion resistant</u> overcoating over the <u>electrically conductive</u> coating, the <u>corrosion resistant</u> overcoating including graphite<u>;</u>

<u>wherein the electrically conductive coating bonds the corrosion resistant overcoating to the metal plate</u>.

14. (Amended) A method as claimed in claim 13, wherein the electrically conductive coating is an emulsion, suspension or paint including graphite particles.

15. (Amended) A method as claimed in claim 13, wherein the corrosion resistant overcoating includes exfoliated graphite.

16. (Amended) A method as claimed in claim 13, wherein the step of providing the corrosion resistant overcoating includes pressing at least one sheet of graphite foil over the electrically conductive coating.

18. (Amended) A method as claimed in claim 13, further comprising the step of:

forming a flow field on the corrosion resistant overcoating.

19. (Amended) A method as claimed in claim 13, further comprising the step of:

mechanically deforming the metal plate, the electrically conductive coating and the corrosion resistant overcoating to create a flow field.

20. (Amended) A method of manufacturing a coated bipolar plate for a fuel cell, the method comprising the steps of:

providing a metal plate [with an outer surface];

providing an electrically conductive coating over the [outer surface] metal plate; and

providing [an] a corrosion resistant overcoating over the electrically conductive coating, the corrosion resistant overcoating being electrically conductive and hydrophobic;

wherein the electrically conductive coating bonds the corrosion resistant overcoating to the metal plate.

21. (New) A coated fuel cell bipolar plate comprising:

a metal plate including an outer surface;

an electrically conductive coating over the outer surface; and

an overcoating formed over the electrically conductive coating, the overcoating including graphite, the overcoating including porosities that are filled by the electrically conductive coating.

22. (New) A coated fuel cell bipolar plate comprising:

a metal plate including an outer surface;

an electrically conductive coating over the outer surface; and

an overcoating formed over the electrically conductive coating, the overcoating including graphite, the overcoating being a foil.

23. (New) A coated fuel cell bipolar plate comprising:

a metal plate including an outer surface;

an electrically conductive coating over the outer surface; and

an overcoating formed over the electrically conductive coating, the overcoating including graphite, the overcoating having a thickness approximately between 0.04 and 1.0 millimeters.

24. (New) A method of manufacturing a coated bipolar plate for a fuel cell, the method comprising the steps of:

providing a metal plate with an outer surface;

providing an electrically conductive coating over the outer surface; and

providing an overcoating over the electrically conductive coating, the overcoating including graphite;

wherein the step of providing the overcoating includes pressing at least one sheet of graphite foil over the electrically conductive coating.

25. (New) A method as claimed in claim 24, wherein the metal plate is heated during the pressing step.